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**PATENT SPECIFICATION**

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**COMPLETE SPECIFICATION**

**Arrangement for Comparing Two Periodically Recurring Cycles of Events for Measuring or Regulating Purposes**

We, ALLMANNA SVENSKA ELEKTRISKA AKTIEBOLAGET, a Swedish Company, of Vasteras, Sweden, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to an arrangement for measuring or regulating the phase relationship between a periodically recurring mechanical cycle of events and another periodically recurring mechanical or electrical cycle of events having practically the same frequency as the first mentioned cycle of events. In particular, the invention is concerned with an arrangement for the register control of multi-colour printing presses in which two or more printing drums are required to print different coloured patterns on a web-paper or the like with the different coloured patterns all correctly registered in relation to one another.

The object of the invention is to provide an arrangement of the above mentioned kind which is of simple construction and very high accuracy and which has a good correction ability within a very large speed range.

According to the invention an arrangement for measuring or regulating the phase relationship between a periodically recurring mechanical cycle of events and another periodically recurring mechanical or electrical cycle of events having practically the same frequency as the first mentioned cycle of events, especially for the register control of multi-colour printing presses, in which two photo-cells are so arranged that they are struck, one immediately after the other, by light beams governed by the first mentioned cycle of events, is characterised by the fact that the two photo-cells serve as gates for electrical impulses governed by the second mentioned mechanical or electrical cycle of events, said gate action generating impulses by means of which the phase relationship between the two cycles of events is determined as to its magnitude and direction.

- [Price 2s. 8d.]

The application of the invention to the register control of a multi-colour printing press will now be described with reference to the accompanying drawings, in which :

Figure 1 is a schematic view of the printing press,

Figure 2 shows the principal arrangement of the photo-electric cells, and

Figure 3 schematically shows the various impulses.

In Figure 1, 1 designates the printing cylinder for the first colour, which also prints in the margin of the web the marks necessary for the register control. 2 is the web, which runs over three rollers (register rollers), 3, 4, 5 of which the roller 4 can be moved in vertical direction by means of the operating motor 6, the connection between roller 4 and motor 6 being represented by the line 6'. From these rollers the web 2 runs to the second printing cylinder 7 and thence over further register rollers to further printing cylinders for the rest of the colours. 8 designates a member containing a photo-cell (22 in Figure 2) which, through an optical system, is actuated by light variations caused by the marks in the margin of the web. 9 designates an indicator which comprises two photo-cells (14 and 15 in Figure 2) of which one is actuated by a light beam from a suitable light source which traverses a series of slots in a disc 10 coupled with the printing cylinder 7; the other photo-cell is actuated by a light beam coming from the said light source and which is reflected from mirrors attached to the disc 10 close to said slots. The mirrors may of course be replaced by a series of slots of the same kind as the above mentioned slots in the disc 10. 28 is an amplifier which governs the operating motor 6 in accordance with the impulses emitted from the photo-cell members.

In Figure 2, 11 is a lamp forming the above mentioned light source, 12 the slots in the disc 10, and 13 the mirrors attached to disc 10 close to said slots. The light beam traversing the slot 12 strikes the photo-cell 14, and the light beam reflected from the

mirrors strikes the photo-cell 15. The cathodes in the photo-cells are designated by 16 and 17, respectively, and the anodes by 18 and 19. The anodes are connected, 5 through an amplifier 27, with the cathode 21 in a photo-cell 22, the anode 23 of the latter being connected with the positive pole current source, not shown on the drawing. 24 designates a lamp which gives a light 10 beam through an optical system; said beam being reflected by the web 2 against the cathode 21 of the photo-cell 22. Due to the marks 26 on the paper web, a variation of the light striking the photo-cell 22 is achieved. 15 Figure 3 demonstrates the function of the device. The curve *a* designates the light impulses from the light beam through the slots 12 and the curve *b* the light impulses from the mirrors 13. By these impulses the 20 cells 14 and 15 are made conducting during the time  $a_1$  and  $b_1$ , respectively. The curve *c* represents the voltage impulses generated by the photo-cell 22, which are impressed upon the anodes 18 and 19 in the cells 14 and 25 15 over the amplifier 27. The cathodes 16 and 17 in these photo-cells are connected with an amplifier 28, which, in its turn, is connected to the operating motor 6 in Figure 1. The amplifier 28 is so designed that the impulses 30 coming from the photo-cells 14 and 15, respectively, act in opposite directions thereon.

The marks 26 give impulses  $c_1$ , which, as mentioned above, traverse the cells 14 and 35 15, but they can only do so during the time periods these cells are exposed to light. The impulses  $c_1$  will, therefore, come to the amplifier 28 either over the cell 14 or the cell 15. If the impulses  $c_1$  occur partly with- 40 in the time  $a_1$  and partly within the time  $b_1$ , they are divided and one part  $d_1$  traverses the cell 14 and the other part  $e_1$  traverses the cell 15. If the impulses  $c_1$  occur earlier, the impulse time  $d_1$  will be longer and the im- 45 pulse time  $e_1$  shorter. If, on the contrary, the

impulses  $c_1$  come later,  $e_1$  will be longer and  $d_1$  shorter. The impulses  $d_1$  and  $e_1$  are transformed in the amplifier 28 to voltages proportional to the impulse durations, and the difference between these voltages is 50 utilised to control the operating motor 6, which by means of the register roller 4 regulates the length of the web between the two printing rollers, so that the right register is attained. 55

What we claim is:—

1. Arrangement for measuring or regulating the phase relationship between a periodically recurring mechanical cycle of events and another periodically recurring mechanical or electrical cycle of events having practically the same frequency as the first mentioned cycle of events, especially for the register control of multi-colour printing presses, in which two photo-cells are so 65 arranged that they are struck, one immediately after the other, by light beams governed by the first mentioned cycle of events, characterised by the fact that the two photo-cells serve as gates for electrical impulses 70 governed by the second mentioned mechanical or electrical cycle of events, said gate action generating impulses by means of which the phase relationship between the two cycles of events is determined as to its 75 magnitude and direction.

2. Arrangement for measurement or regulation of the phase relation between a periodically recurring mechanical cycle of events and another periodically recurring 80 mechanical or electrical cycle of events having practically the same frequency as the first mentioned cycle of events, constructed and arranged substantially as described herein and shown in the accompanying 85 drawings.

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Fig.1

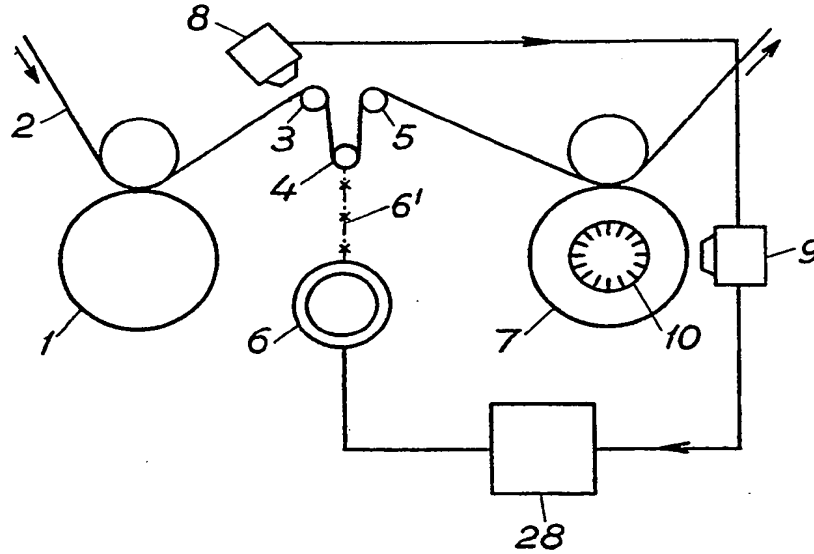
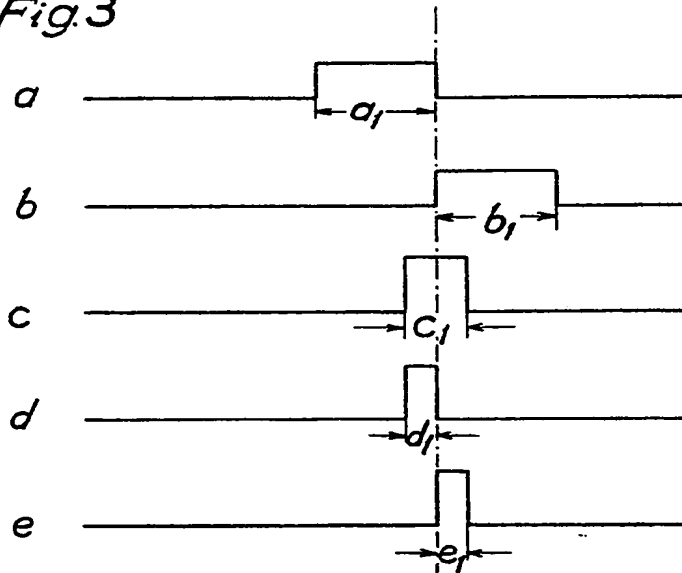
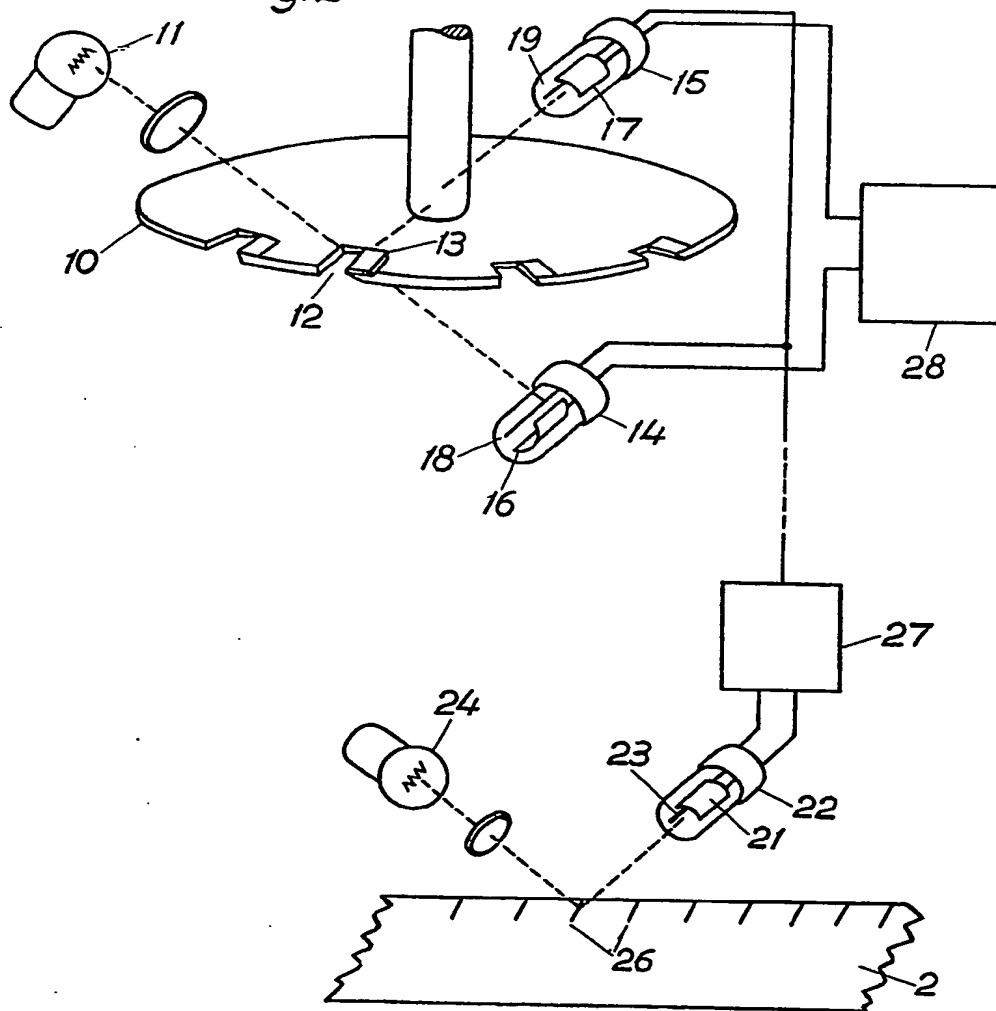


Fig.3



This Drawing is a reproduction of the Original on a reduced scale

Fig.2



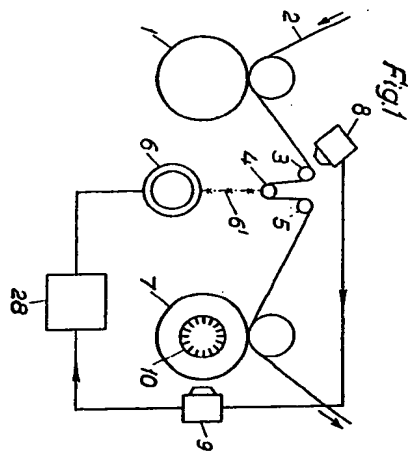


Fig 1

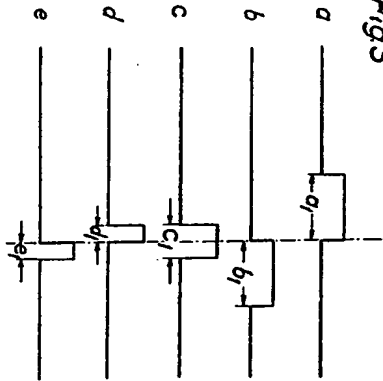


Fig 3

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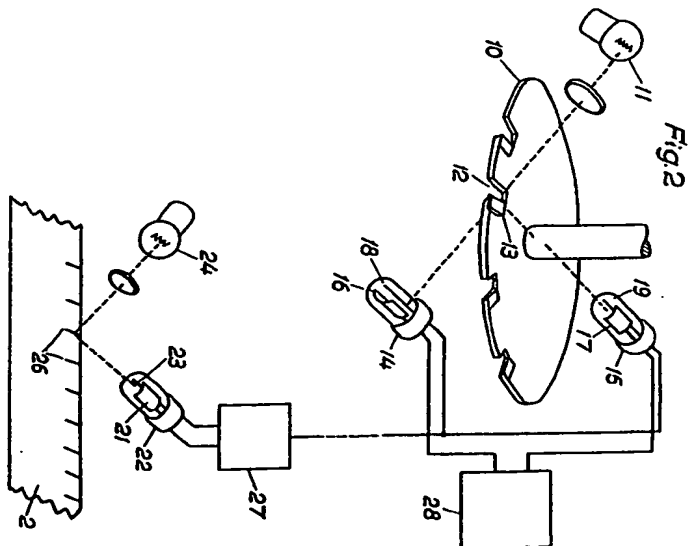


Fig 2